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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/528,678

03/20/2000

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06/28/2004

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EXAMINER

ODOM, CURTIS B

ART UNIT

PAPER NUMBER

2634

13

DATE MAILED: 06/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

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③
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Office Action Summary

Application No.

09/528,678

Applicant(s)

CHAN ET AL.

Examiner

Curtis B. Odom

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 March 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 March 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1, 3, 4, 6, 7, 10, 15, 17, 19, 20, 22, 23 and 26 are rejected under 35 U.S.C. 102(e) as being anticipated by Lee (previously cited in Office Action 12/12/03).

Regarding claim 1, Lee discloses an iterative equalizer (Fig. 2) for a data communication system for recovering received data transmitted over a data channel comprising:

a first filter (Fig. 2, block 203, column 3, line 60-column 4, line 8) for filtering a received data according to first filter parameters to generate first-filtered data;

a combiner (Fig. 2, block 205, column 4, lines 9-22) for modifying the first-filtered data with second-filtered data to generate modified data;

a decision device (Fig. 2, block 206, column 4, lines 9-66) for generating modified tentative decisions based on the modified data, the modified tentative decisions being modified with respect to tentative decisions of a previous iteration; and

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a second filter (Fig. 2, block 204, column 4, lines 9-22) for filtering tentative decisions from a previous iteration according to second filter parameters to generate the second-filtered data;

wherein the first and second filter parameters are based on the received data (column 4, lines 1-14) and the intersymbol interference is removed from the modified data in a nonlinear manner (column 1, lines 31-40), wherein DFE is applied in the present invention to remove intersymbol interference (see column 2, lines 28-53).

Regarding claim 3, which inherits the limitations of claim 1, Lee discloses the equalizer is fractionally-spaced in that the received data is sampled at a rate higher than a symbol rate associated with the received data (column 3, lines 51-59, oversampled).

Regarding claim 4, which inherits the limitations of claim 1, Lee discloses the received data comprises symbol data (column 3, lines 60-64), wherein the previous and current samples.

Regarding claim 6, which inherits the limitations of claim 1, Lee discloses the received data is encoded (column 3, lines 51-59) and the decision device comprises a decoder (Fig. 2, block 201, column 3, lines 36-50). Lee does not disclose using error-correction coding or an error correction decoder and error-correction encoder for the encoding the tentative decisions. However, it would have been obvious to one skilled in the art at the time the invention was made that the encoder and decoder of Lee could have been modified to use error correction encoding and decoding and error correction encoding for the tentative decisions. Error correction encoding and decoding detects and corrects errors in transmitted data. This improves data reliability and data transmission rates in the presence of noise and interference.

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Regarding claim 7, which inherits the limitations of claim 1, Lee discloses the first and second filters comprise filter types selected from the group of filter types consisting of: linear, non-linear, time-variant, time-invariant, IIR, and FIR filters (column 4, lines 1-14).

Regarding claim 10, which inherits the limitations of claim 1, Lee discloses the first filter, combiner, decision device, and second filter are distributed among a data channel transmitter and receiver (Abstract), wherein a transmission system contains a data channel transmitter and receiver.

Regarding claim 15, Lee discloses an iterative equalizer (Fig. 2) for a data communication system for recovering received data transmitted over a data channel comprising:

- a first filter (Fig. 2, block 203, column 3, line 60-column 4, line 8) for filtering a received data according to first filter parameters to generate first-filtered data;

- a combiner (Fig. 2, block 205, column 4, lines 9-22) for modifying the first-filtered data with second-filtered data to generate modified data;

- a decision device (Fig. 2, block 206, column 4, lines 9-66) for generating modified tentative decisions based on the modified data, the modified tentative decisions being modified with respect to tentative decisions of a previous iteration; and

- a second filter (Fig. 2, block 204, column 4, lines 9-22) for filtering tentative decisions from a previous iteration according to second filter parameters to generate the second-filtered data;

wherein the first and second filter parameters are based on an estimate of the channel parameters (column 3, line 60-column 4, line 14, channel energy and optimal

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detection criterion) and wherein the equalizer is fractionally spaced in that the received data is sampled at a rate higher than a symbol rate associated with the received data (column 3, lines 55-59, oversampled) so that intersymbol interference is removed from the modified data in a nonlinear manner (column 1, lines 31-40), wherein DFE is applied in the present invention to remove intersymbol interference (see column 2, lines 28-53).

Regarding claims 17, 19, 20, 22, 23, 26 and 31, the claimed method includes features corresponding to subject matter mentioned in the above rejection of claims 1, 3, 4, 6, 7, 10, and 15 which is applicable hereto.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 2, 5, 12, 14, 16, 18, 21, 28, 30 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (previously cited in Office Action 12/12/03) in view of Ghosh (previously cited in Office Action 12/12/03).

Regarding claims 2, 12, 14, 16, 18, 28, 30 and 32, Lee discloses all the limitations of claims 2, 12, 14, 16, 18, 28, 30 and 32 (see previous rejections of claims 1, 1, 13, 15,

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17, 27, 29, and 31) except modifying the first and second filter parameters at each iteration.

However, Ghosh discloses an iterative equalizer wherein the first and second filter parameters are modified at each iteration (column 6, lines 4-6). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify the filter parameters or Lee at each iteration as taught by Ghosh since Ghosh states that adjusting the filters minimizes errors in the received signals and eliminates relatively consistent interference (column 1, lines 33-37).

Regarding claims 5 and 21, Lee discloses all the limitations of claims 5 and 21 (see rejection of claims 1 and 17) except modifying the first and second filter parameters at each iteration according to channel parameters that are re-estimated at each iteration based on the received data.

However, Ghosh discloses an iterative equalizer wherein the first and second filter parameters are modified at each iteration (column 6, lines 4-6) according to channel parameters that are re-estimated at each iteration based on the received data (Fig. 4, column 8, lines 48-67 and column 9, lines 1-12). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify the filter parameters or Lee at each iteration according to channel parameters that are re-estimated at each iteration based on the received data as taught by Ghosh since Ghosh states that adjusting the filters minimizes errors in the received signals and eliminates relatively consistent interference (column 1, lines 33-37).

5. Claims 11 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (previously cited in Office Action 12/12/03).

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Regarding claim 11, Lee discloses an iterative equalizer (Fig. 2) for a data communication system for recovering received data transmitted over a data channel having channel parameters comprising:

- a first filter (Fig. 2, block 203, column 3, line 60-column 4, line 8) for filtering a received data according to first filter parameters to generate first-filtered data;

- a combiner (Fig. 2, block 205, column 4, lines 9-22) for modifying the first-filtered data with second-filtered data to generated modified data;

- a decision device (Fig. 2, block 206, column 4, lines 9-66) for generating modified tentative decisions based on the modified data, the modified tentative decisions being modified with respect to tentative decisions of a previous iteration; and

- a second filter (Fig. 2, block 204, column 4, lines 9-22) for filtering tentative decisions from a previous iteration according to second filter parameters to generate the second-filtered data;

wherein the first and second filter parameters are based on an estimate of the channel parameters (column 3, line 60-column 4, line 14, channel energy and optimal detection criterion) and wherein the received data is encoded (column 3, lines 51-59) and the decision device comprises a decoder (column 3, lines 27-50) so that intersymbol interference is removed from the modified data in a nonlinear manner (column 1, lines 31-40), wherein DFE is applied in the present invention to remove intersymbol interference (see column 2, lines 28-53).

Lee does not disclose using error-correction coding or an error correction decoder and an error-correction encoder for the encoding the tentative decisions.

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However, it would have been obvious to one skilled in the art at the time the invention was made that the encoder and decoder of Lee could have been modified to use error correction encoding and decoding and error correction encoding for the tentative decisions. Error correction encoding and decoding detects and corrects errors in transmitted data. This improves data reliability and data transmission rates in the presence of noise and interference.

Regarding claim 27, the claimed method includes features corresponding to subject matter mentioned in the above rejection of claim 11 which is applicable hereto.

6. Claims 8, 13, 24, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (previously cited in Office Action 12/12/03) in view of Meehan (previously cited in Office Action 12/12/03).

Regarding claim 8, which inherits the limitations of claim 1, Lee discloses all the limitations of claim 8 (see rejection of claim 1), except the received data comprises a plurality of received signals received over a plurality of data channels, and wherein the equalizer comprises a plurality of first filters corresponding to the plurality of channels.

However, Meehan discloses an equalizer (Fig. 1) wherein the received data comprises a plurality of received signals (column 2, lines 9-34) received over a plurality of data channels, and wherein the equalizer comprises a plurality of first filters (Fig. 1, blocks 232, 228, 248, and 254) corresponding to the plurality of channels. Therefore, it would have been obvious to one of ordinary skill in the art to modify the receiver and equalizer of Lee with the teachings of Meehan in order to improve receiver diversity which would allow the receiver to be implemented into multi-user communication systems. The plurality of filters would reduce multi-user interference which allows for an

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increase in system capacity and allows signal decoding to be carried out efficiently and accurately.

Regarding claim 13, Lee discloses an iterative equalizer (Fig. 2) for a data communication system for recovering received data transmitted over a data channel comprising:

- a first filter (Fig. 2, block 203, column 3, line 60-column 4, line 8) for filtering a received data according to first filter parameters to generate first-filtered data;

- a combiner (Fig. 2, block 205, column 4, lines 9-22) for modifying the first-filtered data with second-filtered data to generate modified data;

- a decision device (Fig. 2, block 206, column 4, lines 9-66) for generating modified tentative decisions based on the modified data, the modified tentative decisions being modified with respect to tentative decisions of a previous iteration; and

- a second filter (Fig. 2, block 204, column 4, lines 9-22) for filtering tentative decisions from a previous iteration according to second filter parameters to generate the second-filtered data;

wherein the first and second filter parameters are based on an estimate of the channel parameters (column 3, line 60-column 4, line 14, channel energy and optimal detection criterion) so that intersymbol interference is removed from the modified data in a nonlinear manner (column 1, lines 31-40), wherein DFE is applied in the present invention to remove intersymbol interference (see column 2, lines 28-53).

Lee does not disclose the data is transmitted over a plurality of data channels wherein the received data comprises a plurality of received signals received over a

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plurality of data channels, and wherein the equalizer further comprises a plurality of first filters corresponding to the plurality of channels.

However, Meehan discloses an equalizer (Fig. 1) wherein the received data comprises a plurality of received signals (column 2, lines 9-34) received over a plurality of data channels, and wherein the equalizer comprises a plurality of first filters (Fig. 1, blocks 232, 228, 248, and 254) corresponding to the plurality of channels. Therefore, it would have been obvious to one of ordinary skill in the art to modify the receiver and equalizer of Lee with the teachings of Meehan in order to improve receiver diversity which would allow the receiver to be implemented into multi-user communication systems. The plurality of filters would reduce multi-user interference which allows for an increase in system capacity and allows signal decoding to be carried out efficiently and accurately.

Regarding claim 24, which inherits the limitations of claim 17, Lee discloses all the limitations of claim 24 (see rejection of claim 17), except the received data comprises a plurality of received signals received over a plurality of data channels, and wherein the equalizer comprises a plurality of first filters corresponding to the plurality of channels.

However, Meehan discloses an equalizer (Fig. 1) wherein the received data comprises a plurality of received signals (column 2, lines 9-34) received over a plurality of data channels, and wherein the equalizer comprises a plurality of first filters (Fig. 1, blocks 232, 228, 248, and 254) corresponding to the plurality of channels. Therefore, it would have been obvious to one of ordinary skill in the art to modify the receiver and equalizer of Lee with the teachings of Meehan in order to improve receiver diversity which would allow the receiver to be implemented into multi-user communication

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systems. The plurality of filters would reduce multi-user interference which allows for an increase in system capacity and allows signal decoding to be carried out efficiently and accurately.

Regarding claim 29, the claimed method includes features corresponding to subject matter mentioned in the above rejection of claim 13 which is applicable hereto.

7. Claims 9 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (previously cited in Office Action 12/12/03) in view of Agazzi (previously cited in Office Action 12/12/03).

Regarding claims 9 and 25, which inherits the limitations of claim 1 and 17, Lee discloses all the limitations of claim 9 and 25 (see previous rejection of claim 1 and 17) except the received data comprises combined data for a plurality of users, and wherein the equalizer further comprises a plurality of second filters for second-filtering the tentative decisions from a previous iteration corresponding to the plurality of users.

However, Agazzi discloses a received with an equalizer wherein the received data comprises combined data for a plurality of users (column 3, lines 1-11), and wherein the equalizer further comprises a plurality of second filters for second-filtering the tentative decisions from a previous iteration (Fig. 7, block 100, column 7, lines 35-52). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the equalizer and receiver of Lee with the teachings of Agazzi in order to improve receiver diversity which would allow the receiver to be implemented into multi-user communication systems. The plurality of filters would reduce multi-user interference which allows for an increase in system capacity and allows signal decoding to be carried out efficiently and accurately.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Ariyavisitakul et al. (U. S. Patent No. 6, 012, 161) discloses a nonlinear equalization method and apparatus for removing ISI using error correction decoding performed jointly on tentative decisions.

Mui (U. S. Patent No. 6, 690, 739) discloses an equalization method and apparatus for removing ISI by performing error correction coding on tentative decisions

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.


10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Curtis B. Odom whose telephone number is 703-305-4097. The examiner can normally be reached on Monday- Friday, 8-5.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on 703-305-4714. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Curtis Odom
June 22, 2004



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